Concerning some West American smuts

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Many of the following notes and descriptions have been prepared for nearly a year and are based mainly upon collections made in 1902 and 1903. The extensive territory visited during these two years has naturally yielded unrecorded species as well as furnished additional data regarding imperfectly known forms. This writing furnishes descriptions of only a part of the new species collected.

The writer is indebted to Professor G. P. Clinton for his kindness in examining and giving critical judgment upon many of the species mentioned here. All the specimens discussed will be found in the U. S. National Herbarium and in my private collection. Nearly all of them are also in Professor Clinton's private herbarium.

Sorosporium contortum sp. nov.

Sori involving the entire upper internode and head which are transformed into a cylindrical or fusiform black compact mass, the spore-balls wearing away from the outside gradually by abrasion or becoming reduced to a powdery mass within the unopened sheath, very variable in length, 5–30 mm. by .6–1.5 mm., completely enclosed within the upper sheath, the internode and head being reduced to a comparatively very short columella, the remainder of the cylinder consisting of the bases of the delicate, much contorted, partially developed awns; sterile membrane long-cylindrical and usually extending fully half its length beyond the sheath, the basal portion enveloping the sorus, but the exterior half or more sterile and containing only the distal parts of the awns, usually more or less contorted, rupturing easily, and becoming lacerated, giving to the plant a very ragged appearance; its cells hyaline, cuboidal to somewhat elongated with longitudinal, rib-like thickenings; spore-balls subglobose to ovoid, and often angular, many-spored, 50–62 μ by 50–80 μ; spores subglobose to angular-compressed, dark fuscous, 5–8 μ in diameter, with thin, smooth epispores, homogeneous contents, and usually very faint, central or eccentric nuclear area.

On *Andropogon contortus* L., Santa Rita Mountains, Arizona (within the area recently fenced by the U. S. Department of Agri-

culture), September 12, 1902 (type); Santa Rita Mountains, Arizona, October 1, 1902 (Griffiths & Thornber); Empire Ranch, Arizona, September 27, 1902 (Griffiths & Thornber).

This is a very common and conspicuous fungus throughout the Santa Rita Mountains. It was abundant in the type locality as well as on the south side of the mountains in 1903, but no collections were made of it. It usually destroys all of the heads on the bunch of grass which it attacks.

Sorosporium Eriochloae sp. nov.

Sori in ovary and surrounded by a sterile membrane which projects but slightly beyond the glumes of the host, its base surrounding the aborted pistil and black powdery mass of spores, but the distil end empty or containing only the distal portions of the aborted pistil; its cells hyaline, slightly longer than broad, upper portion early becoming lacerated and recurved; spore-balls subglobose, angular and very irregular in both outline and size, 50–65 μ by 50–105 μ, easily separable; spores dark fuscous, subglobose, 10–13.5 μ in diameter, angular, with thin, smooth epispore, coarsely granular contents and small but distinct nuclear area.

On *Eriochloa punctata* (Linn.) W. Hamilt., Empire Ranch, Santa Rita Mountains, Arizona, September 28, 1902 (Griffiths & Thornber). The material cited above is quoted as the type because it is more plentiful than other collections which the writer has made. It was collected by me in the spring of 1901 in native hay on the ranch of Col. H. C. Hooker in Sulphur Spring Valley, Arizona, and subsequently observed during the fall of 1903 in various localities in southern Arizona. It is a very common species.

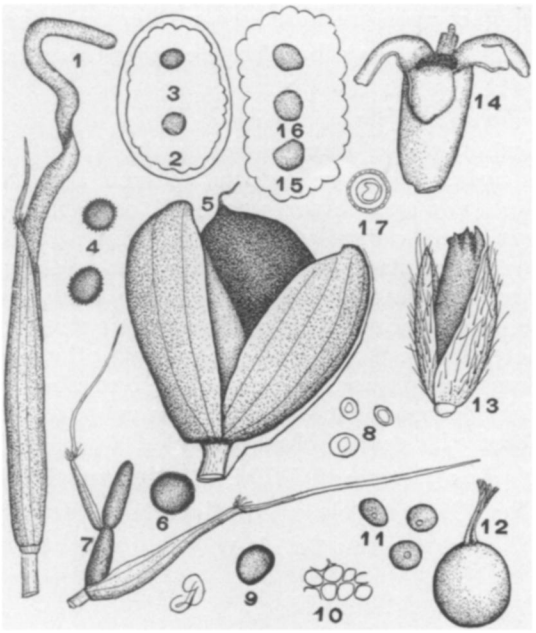
Ustilago lycuroides sp. nov.

Sorus in ovary which is inflated to a globular, olive green body, covered with the thin, wrinkled and modified integument, 1–1.5 mm. in diameter, bearing at its distal end the style and stigma but little modified, the interior being completely filled with a hard, brittle mass of spores which are brown, subglobose to slightly oval and angular, 9.5 to 13 μ in diameter; epispore thin, smooth, contents granular with a distinct central or eccentric nuclear area.

On *Lycurus phleoides* H.B.K., Santa Rita Mountains, Arizona, September, 1902 (Griffiths & Thornber). This appears to be a very rare species. Only a few smutty heads were found. The exact type locality is one mile north of Greaterville, on the road to Rosemont.

Ustilago calcara sp. nov.

Sorus circular, .5 mm. in diameter to linear and confluent, 5 mm. or more in length extending between the veins and erumpent upon the exterior of the modified, overlapping sheaths, and less frequently upon the leaves; internodes and culms in diseased host very much shortened and repeatedly branched, producing miniature witches' brooms; spores sooty, black in mass, irregular, globular to ovate, and often pointed, 7–10 μ by 7–10.5 μ with one



1. *Sorosporium contortum*, showing upper sheath and sterile membrane, × 2. 2. Outline of spore-ball, × 215. 3. Spores, × 315.

4. Spores of *Ustilago Scolochloae*, × 320.

5. *Tilletia pulcherrima* in spikelet of *Panicum obtusum*, × 12. 6. Spore, × 315.

7. Upper portion of culm of *Eragrostis Neo-Mexicana*, showing method of attack of *Ustilago strangulans*. Natural size.

8. Spores of *Ustilago calcara* on *Bouteloua breviseta*, × 315.

9. Spore-ball of *Thecaphora Thornberi*, × 35. 10. Portion of the spore-ball, × 315, showing outlines of the individual spores.

11. Spores of *Ustilago lycuroides*, × 315. 12. Ovary of the host distorted by the smut, × 8.

13. Spikelet of *Eriochloa punctata* showing distortion of ovary by *Sorosporium Eriochloae*, × 5. 14. Distorted ovary showing method of rupture, × 8. 15. Outline of spore-ball, × 215. 16. Spores, × 315.

17. Spore of *Tilletia Wilcoxiana*, × 320.

or more large, irregular, highly refractory central areas; epispore thin and smooth.

On *Bouteloua breviseta* Vasey, upon the gypsum deposits east of Roswell, N. M., May 4, 1903. This smut is very abundant in this region, but is easily overlooked because the effect upon the host is likely to be considered due to the work of insects. It is easily distinguishable from the other two species which appear on the leaves and culms of various species of the genus *Bouteloua*— first, by the effect upon the host; second, by the entire absence of pustules, which are always found in the other two species.

Ustilago Scolochloae sp. nov.

Fructification of the smut involving the leaves of the upper two to four nodes which are reduced to such an extent that the blades of the upper ones remain unopened, remainder of the plant nearly normal; sori normally epiphyllous, but sometimes hypophyllous in a few places on the inner, more delicate leaves; apparently confined to the blades and seldom if ever occurring on the sheaths, long, linear, often confluent the entire length of the leaf but the entire surface soon covered with the sooty mass of spores; spores subglobose, uniform in size and shape, 10–13 μ in diameter, dark, fuscous, but sooty black in mass, densely and uniformly covered with coarse, blunt tubercles.

On *Scolochloa festucacea* (Willd.) L., Donner & Blitzen River, Harney Valley, Oregon, July, 1902 (Griffiths & Hunter). Closely related to *Ustilago echinata* Schröt.

USTILAGO HYPODITIS (Schl.) Fr.

A very peculiar effect of this smut upon one of its common hosts was observed during the past season about 20 miles east of Roswell, N. M. *Distichlis spicata* is very commonly smutted with this species in fields and meadows near the Pecos river where it is reduced but little, if any, in size. In some of the salty ravines which lead up through the gypsum bluffs, however, the host appears to be very much reduced in size by the smut. The internodes are very much shortened and the whole plant reduced to an inch or two in length, with the leaves and sheaths reduced to bract-like structures or in some cases the upper two to four nodes confined within one swollen sheath, presenting an appearance not unlike the common smut upon species of *Hilaria*.

Specimens were collected here on the 7th of May and again on the 5th of September, showing the same effect but more pronounced at the earlier date.

The smut was especially destructive to *Stipa Vaseyi* in the Raton Mountains of Colorado and New Mexico during the past season.

There occurs in California a well-marked variety of this common species on a number of hosts, but it does not seem desirable to give it a name until field work determines whether the characters are constant, because the spores are not distinguishable from some of the common forms. The variation from the typical form on various species of the genera *Stipa*, *Agropyron* and *Elymus* is in the method of attack. Instead of the sorus being within the sheath it occurs on the leaf-blades and inflorescence which are more or less distorted by it. The writer has observed this method of attack on three hosts in California during the past two years. The first collection was made at Cedarville on *Puccinellia airoides* in July; the second on *Sitanion longifolium* in Jess Valley in August, 1902, by myself and Mr. Byron Hunter, and the third near Millwood upon two forms of *Elymus glaucus* by myself last June. In the first and last examples, especially, the hosts were in a very vigorous state of development and this phenomenon may be simply an expression of the vigor of the host. We can hardly suppose that there is difference enough in the structure of these species and their close relatives in the genera *Poa* and *Elymus* upon which the normal form occurs to cause this variation in the method of attack.

USTILAGO HIERONYMI Schröt.

This species is listed on two additional hosts *Bouteloua breviseta* Vasey, upon which it was found rather sparingly about 20 miles east of Roswell, New Mexico, in September, 1903, and *B. Harvardii* Vasey in the Santa Rita Mountains, Arizona, October, 1902. It is often very destructive to the latter species throughout southern Arizona.

USTILAGO STRANGULANS Issat.

This has been observed in but one locality, on *Eragrostis Neo-Mexicana*, in the Santa Rita Mountains, Arizona, near Rosemont,

September, 1902, where it affected every plant upon an acre or more of ground in the vicinity of an old corral where the soil was thoroughly tramped.

Tilletia Wilcoxiana sp. nov.

Sorus produced in ovary of the host which becomes inflated to an olive green fusiform body, three or four times its normal size; spores light brown in mass, but hyaline by transmitted light, subglobose, 15–19 μ in diameter with a narrow, hyaline enveloping membrane but little exceeding the stout, blunt, uniformly distributed projections on the very thick epispore.

On *Stipa eminens Andersonii* Vasey, Santa Monica, California, Spring, 1901 (Dr. H. E. Hasse). Mr. E. N. Wilcox first discovered this smut while studying the genus *Stipa* (see Bot. Gaz. 34: 66. 1902). The same host infested by the same species of smut was collected in the original locality by Dr. Hasse again in April, 1902. In all the material at hand the spores are slightly under mature and the description so far as it relates to the color of the spores may have to be modified later.

TILLETIA PULCHERRIMA E. & G.

A very destructive smut upon *Panicum obtusum* H.B.K. throughout southern Arizona. It has been observed in a dozen localities since the autumn of 1900. It is very easily overlooked. A collection of it was made on the Empire Ranch, Santa Rita Mountains, Arizona, September, 1902.

Thecaphora Thornberi sp. nov.

Sorus in ovary which is inflated more or less symmetrically to a spherical body 4–7 or more mm. in horizontal diameter which usually slightly exceeds the vertical, the modified tissues rupturing irregularly at maturity; spore-balls reddish brown in mass, 70–100μ by 80–120μ, oval, subspherical or sometimes compressed angular, opaque at maturity with the individual spores scarcely distinguishable; spores apparently inseparably united, with thin walls, granular contents, and without visible nuclear areas, about 10 by 13μ. When young the exterior walls of the spores appear slightly reticulated, but this is entirely lost at maturity.

On *Clathrix lanuginosa* Nutt., Santa Rita Mountains, Arizona, about four miles north of Helvetia on the Tucson road, October 4, 1902 (Griffiths & Thornber). It was abundant in this place but has not been observed elsewhere.

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